

*AJ  
cont*

the three-dimensional profile of the aspheric shape being cut. Also, the cutting wheel can be adjusted so that its angle relative to a tangent to the glass at point of cut is close to 90° (and not less than about 70°; not less than about 80° more preferred and not less than about 85° most preferred). In this manner, movement of the cutting support under the cutting wheel, in combination with adjustment of the pitch of the cutting wheel itself, maintains as close to normal (i.e., 90°) the cutting angle as possible, and thus achievement of a clean, efficient cut and breakout of the shape. While particularly beneficial for aspheric shapes where the radius can change from about 2000 mm to below 600 mm, and smaller, across the surface of the shape, cutting of convex glass can also benefit from maintenance of a near normal cutting angle for the cutting tool (i.e., cutting wheel).

IN THE CLAIMS:

Prior to examination, please cancel claims 2-27.



- 2 -

#### Brief Description of the Related Technology

5

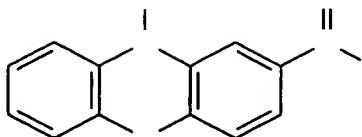
Reversibly variable electrochromic devices are known in the art. In such devices, the intensity of light (e.g., visible, infrared, ultraviolet or other distinct or overlapping electromagnetic radiation) is modulated by passing the light through an electrochromic medium. The electrochromic medium is disposed between two conductive electrodes, at least one of which is typically transparent, which causes the medium to undergo reversible electrochemical reactions when potential differences are applied across the two electrodes. Some examples of these prior art devices are described in United States Patents 3,280,701 (Donnelly); 3,451,741 (Manos); 3,806,229 (Schoot); 4,712,879 (Lynam) ("Lynam I"); 4,902,108 (Byker) ("Byker I"); and I.F. Chang, "Electrochromic and Electrochemichromic Materials and Phenomena", in Nonemissive Electrooptic Displays, 155-96, A.R. Kmetz and F.K. von Willisen, eds., Plenum Press, New York (1976).

Reversibly variable electrochromic media include those wherein the electrochemical reaction takes place in a solid film or occurs entirely in a liquid solution. See e.g., Chang.

Numerous devices using an electrochromic medium, wherein the electrochemical reaction takes place entirely in a solution, are known in the art. Some examples are described in United States Patents 3,453,038 (Kissa); 5,128,799 (Byker) ("Byker II"); Donnelly; Manos; Schoot; Byker I; and commonly assigned United States Patents 5,073,012 (Lynam) ("Lynam II"); 5,115,346 (Lynam) ("Lynam III"); 5,140,455 (Varaprasad) ("Varaprasad I"); 5,142,407 (Varaprasad) ("Varaprasad II"); 5,151,816 (Varaprasad) ("Varaprasad III") and 5,239,405 (Varaprasad) ("Varaprasad IV"); and commonly assigned co-pending United States patent application Serial No. 07/935,784 (filed August 27, 1992) <sup>and now U.S. Patent 5,500,760</sup>.  
Typically, these

EPA  
12-10-04

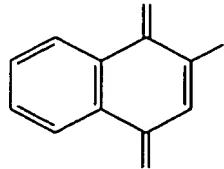
5



2-acetyl-phenothiazine  
("APT")  
4-A

10 An example of a desirable quinone for use as component in the electrochromic monomer composition include, but is not limited to the following structure:

15



20

2-hydroxy-naphthoquinone  
5-A

Combinations of components in the electrochromic monomer composition may be selectively chosen to achieve a desired substantially non-spectral

25 selectivity when the electrochromic element (and the mirror in which the electrochromic element is to function) is dimmed to a colored state.

To render anodic electrochromic compounds I and II electrochemically active in the context of the present invention, a redox pre-contacting procedure must be used. Such a redox pre-contacting procedure is described in the context of preparing anodic compounds for electrochemichromic solutions in Varaprasad IV and 35 commonly assigned co-pending United States patent application Serial No. 07/935,784 (filed August 27, 1992),<sup>and now U.S. Patent 5,500,760</sup>

EAST  
12-10-91

triallyl glucose), polyallyl sucroses (e.g., pentaallyl sucrose diacrylate), glucose dimethacrylate, pentaerythritol tetraacrylate, sorbitol dimethacrylate, diallyl aconitate, divinyl citrasonate, diallyl fumarate, allyl methacrylate and polyethylene glycol diacrylate.

Ultraviolet radiation absorbing monomers may also be advantageously employed herein. Preferred among such monomers are 1,3-bis-(4-benzoyl-3-hydroxyphenoxy)-2-propylacrylate, 2-hydroxy-4-acryloxyethoxybenzophenone, 10 2-hydroxy-4-octoxybenzophenone and 4-methacryloxy-2-hydroxybenzophenone, as they perform the dual function of acting as a monomer component, or a portion thereof, and as an ultraviolet stabilizing agent.

Further, ultraviolet absorbing layers may be coated onto, or adhered to, the first substrate and/or second substrate, and preferably the substrate closest to the source of UV radiation, to assist in shielding the electrochromic device from the degradative effect of ultraviolet radiation. Suitable ultraviolet absorbing layers include those recited in US Patent 5,073,012 15 entitled "Anti-scatter, Ultraviolet Protected, Anti-misting Electro-optical Assemblies", filed March 20, 1990, or as disclosed in copending US Patent Application 08/547,578 filed October 24, 1995, the disclosures of which are hereby incorporated by reference herein.

30 Examples of such layers include a layer of DuPont BE1028D which is a polyvinylbutyral/polyester composite available from E.I. DuPont de Nemours and Company, Wilmington, Delaware, and SORBALITE<sup>TM</sup> polymeric UV blockers (available from Monsanto Company, St. Louis, 35 Missouri) which comprise a clear thin polymer film, with UV absorbing chromophores incorporated, such as by

*EJL  
12-10-04*

optionally be combined with inorganic and organic films such as those of metal oxides (e.g.,  $\text{WO}_3$ ,  $\text{NiO}$ ,  $\text{IrO}_2$ , etc.) and organic films such as polyaniline. Examples of such films are found in copending US Patent Application 08/429,643 filed April 27, 1995, <sup>now U.S. Patent 5,724,187,</sup> <sub>1</sub> copending US Patent Application 08/547,578 filed October 24, 1995, <sup>now U.S. Patent 5,729,379,</sup> <sub>1</sub> and copending US Patent Application 08/330,090 filed October 26, 1994, <sup>now U.S. Patent 5,780,160,</sup> <sub>1</sub> the disclosures of which are hereby incorporated by reference herein. Also, the devices of this present invention can benefit from the use of elemental semiconductors layers or stacks, PRM, anti-wetting adaption, synchronous manufacturing, multi-layer transparent conducting stacks incorporating a thin metal layer overcoated with a conducting metal oxide (such as a high reflectivity reflector comprising around 1000 Å of silver metal or aluminum metal, overcoated with about 1500 Å of ITO and with a reflectivity greater than 70%R and a sheet resistance below 5 ohms/square), conducting seals, variable intensity band pass filters, isolation valve vacuum backfilling, cover sheets and on demand displays such as are disclosed in copending US Patent Application 08/429,643 filed April 27, 1995, <sup>now U.S. Patent 5,724,187,</sup> <sub>1</sub> the disclosure of which is hereby incorporated by reference herein.

Also, as further disclosed in copending US Patent Application 08/429,643, <sup>now U.S. Patent 5,724,187,</sup> <sub>1</sub> the solid polymer films of this present invention may comprise within their structure electrochromatically active phthalocyanine-based and/or phthalocyanine-derived moieties including transition metal phthalocyanines such as zirconium phthalocyanine and molybdenum phthalocyanine. Also, the solid polymer films of this invention can be combined with an electron donor (e.g.  $\text{TiO}_2$ ) - spacer (salicylic acid or phosphoric acid bound to the  $\text{TiO}_2$ ) - electron acceptor (a viologen bound to the salicylic acid or to the phosphoric acid) heterodyad such as described also in US Patent Application 08/429,643. <sup>(now U.S. Patent 5,724,187)</sup> <sub>1</sub> Such donor-spacer-

5

10

15

20

30

35

*EPD  
12-10-04*

5 acceptor solid films can function as an electrochromic solid film in combination with the polychromic solid films of the present invention. Further, such as described in US Patent Application 08/429,643, such chemically modified nanoporous-nanocrystalline films, such as of TiO<sub>2</sub>, with absorbed redox chromophores, can be used in a variety of electrochromic devices and device constructions, including rearview mirrors, glazings, architectural and vehicular glazings, displays, filters, contrast enhancement filters and the like.

10

15

20

25

30

35

Many electrochromic compounds absorb electromagnetic radiation in the about 290 nm to about 400 nm ultraviolet region. Because solar radiation includes an ultraviolet region between about 290 nm to about 400 nm, it is often desirable to shield such electrochromic compounds from ultraviolet radiation in that region. By so doing, the longevity and stability of the electrochromic compounds may be improved. Also, it is desirable that the polychromic solid film itself be stable to electromagnetic radiation, particularly in that region. This may be accomplished by adding to the electrochromic monomer composition an ultraviolet stabilizing agent (and/or a self-screening plasticizer which may act to block or screen such ultraviolet radiation) so as to extend the functional lifetime of the resulting polychromic solid film. Such ultraviolet stabilizing agents (and/or self-screening plasticizers) should be substantially transparent in the visible region and function to absorb ultraviolet radiation, quench degradative free radical reaction formation and prevent degradative oxidative reactions.

As those of ordinary skill in the art will readily appreciate, the preferred ultraviolet stabilizing agents, which are usually employed on a by-weight basis, should be selected so as to be compatible with

EPA  
12-10-04

copending US Patent Application 08/429,643 filed April 27, 1995, <sup>now U.S. Patent 5,724,187</sup>, the disclosure of which is hereby incorporated by reference herein. Preferably, the heater is combined with the mirror reflector mounting plate (also known in the automotive mirror art as the mirror backing plate or the mirror backplate). More preferably, the heater and/or the mirror backing plate is formed (such as by injection molding, extrusion and the like) of a conductive polymer material such as a polymer resin incorporating conductive carbon or conductive metal flakes or fibrils (such as of copper, brass, aluminum, steel or equivalent metal). Most preferably, the heater and the mirror backing plate are formed and attached to the mirror element in an integral molding operation as follows. The mirror reflector glass (that preferably is an electrochromic mirror cell but that, optionally, can be a conventional mirror reflector such as chromed glass) is placed in a mold. A heater (such as a positive temperature coefficient heater pad, or a pad formed from a conductive polymer resin that incorporates metal or carbon conducting particles, or a pad formed from a resin that is intrinsically self-conducting in its resin structure such as a polyaniline resin), is either injection molded onto the rearmost glass surface of the glass reflector element (optionally, with an adhesion promoting primer already applied to the rearmost glass surface and/or with a heat transfer agent applied to the rearmost glass surface), or is attached to the rearmost glass surface (or is already pre-attached to the rearmost glass surface) using a double-sticky tape or a hot melt adhesive (preferably, also conducting and/or of high heat transfer efficiency such as aluminum foil). Finally, a plastic resin is injection molded to form the mirror backing plate (and, optionally, the bezel around the outer perimeter of an electrochromic sideview mirror sub-assembly as is

consumer simply removes the existing interior rearview mirror assembly from the windshield button it is attached to in the vehicle. Then, the consumer attaches the pod module windshield button mount to the windshield button attached to the windshield (this can be achieved either by sliding on and securing with a screwdriver, or by snap-on in a manner conventional in the mirror mounting art). Finally, the consumer now attaches the rearview mirror assembly to the windshield button replication structure that is part of the aftermarket pod module. Since the windshield button shape is largely an industry standard (but the interior rearview mirror mount that attaches thereto is typically not standard), by using this "button on a button" pod module design, an aftermarket product (such as a pod module incorporating a home access transmitter, a universal garage door opener, a security monitor such as a pyroelectric intrusion detector (such as disclosed in copending US Patent Application 08/720,237 filed September 26, 1996, <sup>(now abandoned)</sup> the disclosure of which is hereby incorporated by reference herein), a remote keyless entry receiver, a compass, a temperature and/or clock function and the like) may be readily installed by the vehicle owner, and the existing rearview minor assembly can be readily remounted in the vehicle.

JGZ  
12-10-04  
20

Also, a cellular phone can be incorporated into the interior mirror assembly with its antenna, optionally, incorporated into the outside sideview mirror assembly or into the inside rearview mirror assembly. Such mounting within the mirror assemblies has several advantages including that of largely hiding the cellular phone and antenna from ready view by a potential thief. Further, a seat occupancy detector coupled to an air bag deployment/disable monitor can be located at, within or on the interior rearview mirror

temperature display with a base prismatic interior mirror, or with a base electrochromic interior mirror, or with a compass prismatic interior mirror, or with a compass electrochromic interior mirror) for an individual vehicle as it passes down the vehicle assembly line. Thus, the automaker can offer a wide array of options to a consumer from an option menu. Should a specific customer select an external temperature display for a particular vehicle due to be manufactured by an automaker at a particular location on a specific day/hour, then the mirror system supplier sends to the vehicle assembly plant, in-sequence and/or just-in-time, a set of an interior rearview mirror assembly and at least one outside sideview mirror assembly for that particular vehicle being produced that day on the assembly line, and with the outside sideview mirror equipped with an external temperature sensor and with the interior rearview mirror assembly equipped with an external temperature display. Such just-in-time, in-sequence supply (which can be used for the incorporation of the various added features recited supra and below) is facilitated when the vehicle utilizes a car area network such as is described in Irish Patent Application No: 970014 entitled "A Vehicle Rearview Mirror and A Vehicle Control System Incorporating Such Mirror", application date January 9, 1997, the disclosure of which is hereby incorporated by reference herein, or when multiplexing is used, such as is disclosed in US Patent Application No. 08/679,681 entitled "Vehicles Mirror Digital Network and Dynamically Interactive Mirror System", invented by O'Farrell et al., and filed July 11, 1996, <sup>now U.S. Patent 5,798,575,</sup> the disclosure of which is hereby incorporated by reference herein. Also, given that an interior electrochromic mirror can optionally be equipped with a myriad of features (such as map lights, reverse inhibit line, headlamp activation, external temperature display,

beneficial properties and characteristics of the polychromic solid films and electrochromic interior automotive mirrors manufactured therewith.

**A. Synthesis and Isolation of RMPT**

5

We synthesized 2-methyl-phenothiazine-3-one according to the procedure described in European Patent Publication EP 0 115 394 (Merck Frosst Canada). To reduce MPT to RMPT, we followed the redox procedure described in commonly assigned co-pending United States patent application Serial No. 07/935,784 (filed August 27, 1992), now U.S. Patent 5,500,760

*Edd  
12-10-04*

10

15

**B. Preparation of Electrochromic Monomer Composition**

20

25

We prepared an electrochromic monomer composition according to the present invention comprising about 3.7% HVBF<sub>4</sub> (as a cathodic compound), about 1.6% RMPT (as an anodic compound), both homogeneously dispersed in a combination of about 47.4% propylene carbonate (as the plasticizer) and, as a monomer component, about 52.6% "IMPRUV" (an ultraviolet curable formulation). We thoroughly mixed this electrochromic monomer composition to ensure that a homogeneous dispersion of the components was achieved.

**C. Mirror Assembly with Electrochromic Monomer Composition**

30

35

We assembled interior automotive mirrors from HW-ITO coated glass substrates (where the conductive surface of each glass substrate faced one another), with both the clear, front glass and the silvered, rear glass having a sheet resistance of about 15.ohms per square. The dimensions of the mirror assemblies were about 2.5"

In this example, we chose to illustrate the beneficial properties and characteristics of the polychromic solid films manufactured within electrochromic glazings, that may be used as small area transmissive devices, such as optical filters and the like.

5

**A. Preparation of Electrochromic  
Monomer Composition**

We prepared an electrochromic monomer composition comprising by weight about 2.5% HVBF, (as a cathodic compound), about 1.1% MPT having been previously reduced by contacting with zinc [see Varaprasad IV and commonly assigned co-pending United States patent application Serial No. 07/935,784] (as an anodic compound), both homogeneously dispersed in a combination comprising, in combination as a plasticizer, about 47.7% propylene carbonate and about 1% acetic acid, and about 47.7% "QUICK CURE" B-565 (as a monomer component). We thoroughly mixed this electrochromic monomer composition to ensure that a homogeneous dispersion of the components was achieved.

10  
15  
EPA  
12-10-04  
20

25

**B. Glazing Assembly With Electrochromic  
Monomer Composition**

We assembled electrochromic glazings from HW-ITO coated glass substrates (where the conductive surface of each glass substrate faced one another), with the glass having a sheet resistance of about 15 ohms per square. The dimensions of the glazing assemblies were about 2.5" x 10" x 53  $\mu\text{m}$ , with a weather barrier of an epoxy resin coupled with spacers of about 53  $\mu\text{m}$  also applied.

30

35

We placed into these glazing assemblies the electrochromic monomer composition of Example 11(A),

a multi-layer metal reflector coated glass (consisting of about 200 angstroms of rhodium undercoated with about 1500 angstroms of chromium, and with the chromium being disposed between the rhodium layer and the glass surface so as to serve as an adhesion promoter layer such as is described in US Application No. 08/238,521 filed May 5, 1994, now U.S. Patent 5,668,663, the disclosure of which is hereby incorporated by reference herein) for the rear substrate (where the conductive surface of each glass substrate faced one another), with the clear front glass having a sheet resistance of about 15 ohms per square and the rear multi-layered reflector coated glass having a sheet resistance of about 5 ohms per square. The dimensions of the mirror assemblies were about 3.5" x 7.5" x 105  $\mu$ m, with a weather barrier of an epoxy resin coupled with spacers of about 105  $\mu$ m also applied.

20 We placed into these mirror assemblies the electrochromic monomer composition of Example 34 (A), supra, using the vacuum back filling technique (as described in Varaprasad III, supra).

25 C. Transformation of Electrochromic Monomer Composition within Mirror to Polychromic Solid Film

Once the electrochromic monomer composition of Example 34 (A), supra, was uniformly applied within the mirror assemblies of Example 34 (B), supra, we placed the assemblies in an electrically heated convection oven maintained at about 80°C for about 2 hours whereupon the monomer composition reacted to form in situ the solid polymer matrix film inside the mirror.

35 D. Use of Electrochromic Mirror

*C  
and*

33. (New) The variable transmission assembly according to claim 1, wherein at least one of said substrates is constructed from tinted glass.

34. (New) The variable transmission assembly according to claim 1, wherein the spaced-apart distance between said first substrate and said second substrate is from about 10 micron to about 1000 micron.

35. (New) The variable transmission assembly according to claim 34, wherein the spaced-apart distance is from about 20 micron to about 200 micron.

*EAT  
12-10-04*

36. (New) The variable transmission assembly according to claim 35, wherein the spaced-apart distance is from about 37 micron to about 74 micron.

37. (New) The variable transmission assembly according to claims 1, comprising a boundary seal made from a polymeric material.

38. (New) The variable transmission assembly according to claims 37, wherein said polymeric material comprises an epoxy resin, a plasticized polyvinyl butyral, an ionomer resin, a polyamide material, a nitrile containing polymer, or a butyl rubber.

39. (New) The variable transmission assembly according to claims 37, wherein said boundary seal comprises spacers.

40. (New) The variable transmission assembly according to claim 1, wherein said electrochromic monomer composition includes a monomer component selected from the group consisting of acrylated urethanes, acrylated heterocyclics and acrylate resins.